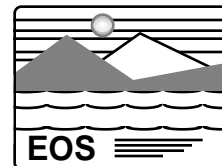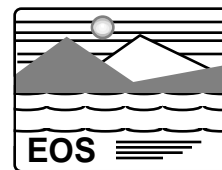# SCIENCE OPERATIONS

GREG HUNOLT
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ECS Replan Versus AM-1 Science Operations

- **Release A is late (May 15), full Release B is late, split between B0 for launch, B1 to follow postlaunch, firm schedule TBD pending completion of replan, due by December 16**

- **Detailed ECS Release B0/B1 schedules (for development, I&T, EGS testing and certification) will be part of replan**

- **ESDIS will ensure that critically needed science operations support for AM-1 will be ready at launch, based on ECS B0 or, if necessary, a backup for B0**

- **ESDIS/DAAC preparations for AM-1 Science Operations are inconvenienced**

- **B0 will involve operational workarounds – rework of operations concepts, scenarios, procedures, staffing, training plans, etc., will follow (schedule will be part of replan)**

- **Detailed DAAC by DAAC plans/schedules will be updated**

AM-1 Science Operations: Objective and Approach
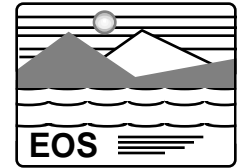
- **Theme: "Data to the People" ...**

- **Product generation and quality assurance, cataloging, archiving, distribution of science data and supporting information, user support for science community and other users**

- **Starts with delivery of AM-1 level-zero data to DAAC door from EDOS and ends with satisfied user (e.g., instrument teams, researchers)**

- **Approach**

  - **Establish EOSDIS DAACs as operating institutions to perform Science Operations**

  - **Project monitors and, as needed, coordinates**

  - **Next charts expand on these**

AM-1 Science Operations
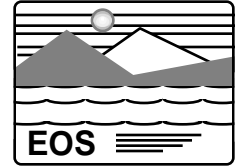
- **DAACs as operating institutions perform Science Operations**
  - **Responsible for coordinating with other sites on dependencies (e.g., data needed for local production)**
  - **Use Version 0 as Science Operations system today**
  - **AM-1 Science Operations to be supported by ECS (A/B0/B1)**
  - **ECS management tools provide means for local system management and inter-site coordination**
- **Project monitors and, as needed, coordinates**
  - **Overall system performance, mission requirements**
  - **Work informally today**
    - » **Limited tools – statistics gathering and reporting**
    - » **Appropriate for Version 0 environment – autonomous sites, no cross-site dependencies**
  - **Work more rigorously in AM-1 era**
    - » **ECS SMC tools provide means for overall monitoring and, as needed, coordination**
    - » **Appropriate for robust multi-site operation with cross-site dependencies**
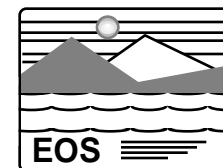
EOSDIS DAACs
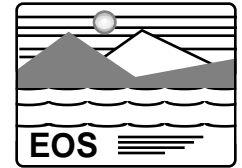
- **DAACs – EOSDIS institutions for performing Science Operations**
  - **Provide data ingest, product generation, archive, catalog, distribution and user support services – "Data to the People"**
  - **Provide access to EOS and non-EOS NASA Earth science data and all supporting information needed by users to choose and use – with an emphasis on quality for near and long term**
  - **Respond to science priorities and guidance [e.g., User Working Groups, EOS Investigator Working Group (IWG)]**
  - **Cooperate with other DAACs as integral parts of EOSDIS**
- **ESDIS Project**
  - **Responsible for EOSDIS implementation and operation**
  - **Responsible for DAACs and system-wide integrity and performance**
- **Project and DAACs working to an agreed-on sharing of roles and responsibilities**
- **Objective: Maximize DAAC autonomy, but preserve integrity of EOSDIS as an overall system to support MTPE interdisciplinary, multidisciplinary research program and to support broader use of NASA data and information**
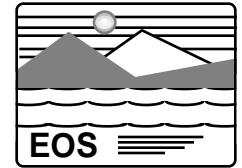
DAACs, Their Discipline and AM-1 Assignments

EOS

- **Alaska SAR Facility (University of Alaska –Fairbanks)** — Synthetic Aperture Radar Study, Polar Processes

- **EROS Data Center (USGS)** — Land Processes Imagery
  AM-1 MODIS Land, ASTER

- **Goddard Space Flight Center (NASA)** — Upper Atmosphere, Atmospheric Dynamics, Global Biosphere, Geophysics
  AM-1 MODIS

- **Jet Propulsion Laboratory Interaction (Cal Tech)** — Ocean Circulation and Air-Sea

- **Langley Research Center Tropospheric (NASA)** — Radiation Budget, Aerosols, Chemistry
  AM-1 CERES, MISR, MOPITT

- **Marshall Space Flight Center (NASA)** — Hydrology

- **National Snow and Ice Data Center (University of Colorado)** — Cryosphere (non-SAR)
  AM-1 MODIS Cryospheric

- **Oak Ridge National Laboratory (DOE)** — Biogeochemical Dynamics

- **Socio-Economic Data Applications Center (CIESIN)** — Policy/Decision Making Applications of Combined MTPE and Socio-Economic Data

DAACs and EOSDIS Version 0

- **Version 0 is distributed system used by DAACs to serve science users effectively and**

  - **In the course of a cooperative development effort, establish working relationships among users, DAACs, and ESDIS Project that will be essential to success for EOSDIS in AM-1 era**

- **Version 0 is a working prototype with operational elements to support ingest, archive, catalog, and distribution of data by DAACs**

  - **Build on heritage systems at DAACs, bring all DAAC systems to a baseline level of capability**

  - **Prototype browse services, common data format, coordinated user services across DAACs**

  - **Develop expertise, lessons learned, elements for use in later EOSDIS versions, prove concepts**

DAACs and EOSDIS Version 0 (Cont'd)
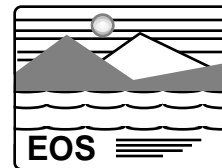
- **Version 0 provides "one-stop shopping" for all data held by DAACs [and NOAA SAA, with international links to Committee on Earth Observation Satellites (CEOS) partners in test] – Cross-DAAC catalog/ordering system with World Wide Web and down-loadable GUI client software**

- **For example, knowing geophysical parameters and spatial/temporal overage of interest, a user can find data sets containing needed parameters, learn about them, and select and order data without having to know data set names, locations, missions, etc., in advance**

Science Operations: Run-Up to AM-1

EOS
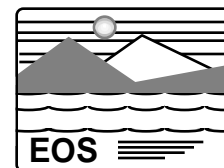
- **Bring in ECS to augment Science Operations systems at DAACs**
    - **Support TRMM (ECS Release A)**
    - **Support AM-1, Landsat 7, SAGE III (ECS Release B0/B1)**
    - **Provide robust, long-term archive and improve access to Version 0 data**
- **DAAC activities**
    - **Monitor ECS development**
        - » **Ensure DAAC requirements are met**
        - » **Operations concepts and scenarios, operations procedures, etc.**
    - **Support installation – facility preparation, etc.**
    - **Testing – review and approve tests at DAAC sites, participate in testing**
    - **Operational readiness – preparation and exercises**
    - **Operational transition (from Version 0 system to mixed ECS-V0, and ECS Release A to Release B)**
        - » **Version 0 to ECS data migration**
        - » **Operations transition (including parallel V0-ECS operations)**
        - » **Science operations in mixed ECS-V0 environment**

AM-1 Operational Readiness
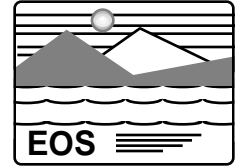
- **DAACs**
  - **With coordination by ESDIS Project and input and advice from Hughes operations veterans**
  - **Will develop set of site-specific AM-1 (L7) operational readiness plans for ECS B0 based system transitioning to B1**

- **Operations Working Group, DAAC-led, Project and DAACs**
  - **Forum for coordination, ensuring needed systems-level synchronization, proper mesh with mission operations**

- **Operational readiness plans will address staffing, training, operations procedures, CM and sustaining engineering, system status, readiness exercises, reviews**

Sample High Level AM-1 Science Operations Scenarios
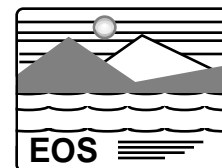
- **AM-1 data ingest, archiving, and archive maintenance**

- **AM-1 data processing, ordering, quality assessment, distribution, and archive**

EOS
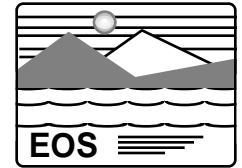
- **Data are ingested from selected sources and placed in DAAC archive**

  - **EOS level-zero data from EDOS**

  - **Non-EOS data from Affiliated Data Centers (ADCs) and Other Data Centers (ODCs)**

  - **User data**

- **Archive maintenance serves to monitor and maintain integrity of data in the archive**

  - **Subset of archived data is routinely checked for data degradation or corruption**

  - **Degraded or corrupted data refreshed or replaced as required**

AM-1 Data Ingest, Archiving, and Archive Maintenance Scenario

EOS

SMC — Collect Production and Archive Status - Develop Consolidated Reports

Affiliated/Other Data Centers — Schedule Data Availability → Transmit Data; production status summary; archive status summary

EOS — Transmit Level 0 Data; data & metadata; Level 0 Backup Archive; Retrieve L0 Data from Backup Archive

DAACs — Level 0 data files; Ingest & Quality Check ADC/ODC Data; Generate & Quality Check Data Granules & Metadata; ADC data; DAAC-EDOS replacement data sets; Check Quality of Data/Metadata; data corrupted; Request Replacement L0 Data from EDOS; L0 data (tape); Ingest & Quality Check EOS L0 Data; Generate & Quality Check L0 Data Granules & Metadata; L0 data; Archive Data, Metadata & Quality Reports; data degraded; Regenerate Standard Data Products; updated metadata; Ingest & Quality Check L0 Data; updated L0 data & metadata; Ingest & Quality Check User Data; Generate & Quality Check User Data & Metadata; User data; Convert to Tape Media; Sample Data Archive; Refresh Data/Metadata; replacement data products; refreshed data; Read Media & Convert to DAAC Format; DAAC Archive; DAAC Archive; DAAC Archive

USER — user data electronic input; Prepare Data to DAAC Specification; media; documents; Ship to DAACs

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- **Data processing generates standard data products from EOS level-zero data utilizing science algorithms/code developed by AM-1 Instrument Teams and places standard products in DAAC archives**

- **Data ordering includes subscription orders and retrospective orders**

    - **Users may subscribe to receive specified standard products whenever the product is produced and available**

    - **Users may request products retrospectively from a list of existing and "virtual" products**

    - **Quality assessment includes automated and manual quality checking, and science data quality assurance performed at the SCFs**

    - **Data distribution stages and delivers products to users electronically and as media**
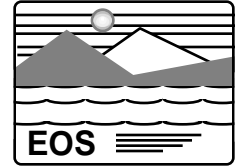
# AM-1 Data Processing, Ordering, Quality Assessment, and Distribution Scenario

EOS

SMC

- Maintain Customer Profile and ESDIS Policy
- Collect Production Status - Maintain Accounting Information - Compute Cost Develop Consolidated Reports

DAACs

- customer requirements
- Generate Standard Data Products
- Perform Automated Quality Checking of Data Products & Metadata
- level 0 data
- standard products
- data products & metadata
- DAAC Archive
- Perform Manual Quality Checking
- updates
- Implement SCF Updates
- data products & metadata
- new user registration & approval
- data orders
- product request approval
- production status summary
- existing product
- virtual product
- Generate Subscription Orders
- Retrieve Data Product from Archive
- Stage Data Products for Delivery
- Convert to Media Product
- production status summary
- data products
- production status summary
- DAAC Archive
- products & metadata
- Generate Retrospective Orders
- Plan & Schedule Production Requests
- Retrieve Data from Archive
- Generate Data Products & Metadata
- electronic data products
- media formatted data product
- Provide Materials & Browse Data
- Prepare Product Order & Cost

USER

- operations
- QA flags
- science software
- other • • • •
- Connect to DAAC
- Generate Data Product Request
- Place Order for Data Product
- Receive Data Products

SCF

- Conduct product analysis & problem resolution
- Generate SCF Updates
- analysis results
- Evaluate Instrument Impacts

DAAC Status in Summary

- **All DAACs are up and running, providing data and information services to many users**

- **All DAACs (except SEDAC and ORNL) are actively working with AM-1 EOS instrument teams**

- **All DAACs (except SEDAC) are heavily engaged in monitoring and guiding ECS development, and planning transitions to (mostly) ECS-based systems**

- **All DAACs (except SEDAC) are planning for future (mostly) ECS-based operations**

- **All DAACs are engaged in facility preparation for ECS, including new buildings at LaRC, EDC, and GSFC, planning for expanding space at ASF, NSIDC, JPL**

- **GSFC, LaRC, and EDC DAACs have completed science software installation and test for AM-1 beta versions**

Science Software Integration and Test
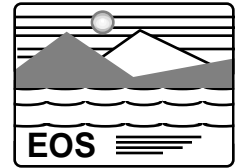
- **Science Software Integration and Test (SSIT) is the process of porting, integrating, and testing science software into the DAAC-resident ECS**

- **SSIT is the only place where Instrument Team (IT), DAAC, and ECS Development personnel work together to accomplish this extremely important function**

- **SSIT success depends on the individual expertise these organizations offer to integrate the science data processing "engines" into ESDIS to produce higher level products in a production environment**

- **ESDIS is responsible for facilitating and otherwise ensuring the success of SSIT**
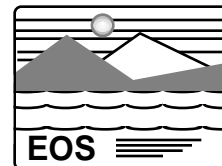
Purpose of SSIT
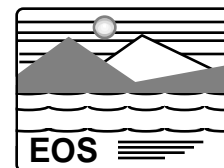
To ensure that the

- **Software provided by ITs**
- **System, known as ECS, as developed by HAIS**
- **Environment hosted by the DAAC**

Work together!

Science Software Related Status

- **ECS IR-1 delivered to LaRC, GSFC, and EDC DAAC**

- **SSIT has completed for TRMM and AM-1 instruments**

- **HAIS Science Office personnel trained on using SSIT tools supporting SSIT**

- **SDP Toolkit incrementally delivered (six increments over past 2 years)**

- **SCF version of SDP Toolkit to support Science Software development for EOSDIS Version 1 delivered May 1996**

- **DAAC version of SDP Toolkit to be delivered with EOSDIS Delivery 1 (ECS Release A)**

- **Remote SSIT function implementation being enhanced for EOSDIS Delivery 1 (ECS Release A)**

AM-1 Science Operations Status in Summary
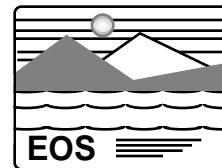
- **Could be better...**

- **ECS uncertainties cloud picture pending replan**

- **Confident B0 will provide urgently needed capabilities at AM-1 launch, with B1 some months later (B1 date depends on Project, Instrument Team, DAAC planning once there is a delivery schedule from ECS)**

- **Confidence will be validated or refuted by detailed schedules versus resources as replan is completed**

- **In any case, ESDIS will provide critically needed science operations support at AM-1 launch**

- **A lot of detailed work ahead**